

Using Flood Planning Constraints Category Mapping in Planning Activities – an example considering NSW Practice

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Abstract

The National Flood Risk Advisory Group (NFRAG) recently completed work on the Australian Institute of Disaster Resilience (ADR) Guideline 7-5 Flood Information to Support Land Use Planning Activities (Guideline 7-5) and ADR Practice Note 7-7 Considering Flood Risk in Land Use Planning Activities (Practice Note 7-7). These documents provide guidance on how to develop information on flood risk to more readily be able to support land use planning. This paper discusses how these guidelines could be used to inform land use planning.

The ADR guideline and practice note and other related ADR handbook 7 series documents are available at: <https://www.aidr.org.au/publications/handbook-collection/handbook-7/> and will be available through the ADR knowledge hub: www.knowledge.aidr.org.au in the near future.

1. Introduction

Occupation of floodplains, whether due to the legacy of former decisions or as a result of future decisions comes with an inherent flood risk. Best practice promotes the consideration and, where necessary, management of flood impacts to existing and future development within the community. It aims to improve community flood resilience using a broad risk management hierarchy of avoidance, minimisation and mitigation to: reduce the health, social and financial costs of occupying the floodplain; increase the sustainable benefits of using the floodplain; and improve or maintain floodplain ecosystems dependent on flood inundation.

Development within the floodplain can expose land uses and their occupiers to a significant risk of flooding, it can impact upon flood behaviour, and can affect the flood vulnerability of existing developments and their users.

The floodplain management process can provide the basis for understanding flood behaviour and how this may vary across the floodplain and between events of different sizes. This can provide a basis for breaking down the floodplain in consideration of varying: flood function, flood hazard, flood risk, flood frequency and emergency response difficulty.

This breakdown provides the basis for providing advice on the flood related constraints that need to be considered to effectively manage flooding and its impacts in different areas of the floodplain. Flood studies are generally captured for a township, floodplain or a catchment. Information on flooding can be combined across a LGA so that it can be used to uniformly inform land use planning activities.

These land use planning activities, may include setting strategic directions at a regional or local scale, as well as the implementation of such directions through planning instruments (for example Local Environmental Plans, LEPs, and Development Controls Plans, DCPs).

This paper examines, as an example, how flood planning constraint categorisation and associated advice could be applied to land use planning activities to achieve the objectives of floodplain management. It provides the following information:

- Section 2 provides typical floodplain management objectives as outlined in Guideline 7-5.
- Section 3 discusses the implications of flooding and the key consideration for different areas of the floodplain.
- Section 4 provides advice on flood planning constraint categories (FPCCs) developed consistent with Guideline 7-5 and examples of land-use planning, and building treatment options and controls in consideration of floodplain management objectives.
- Section 5 discusses how FPCC's could be considered in strategic land use planning activities at a local or regional scale.
- Section 6 discusses the use of FPCCs in the land use planning system, using NSW as an example.

2. Typical Floodplain Management Objectives from AIDR 2017a

Guideline 7-5 provides typical floodplain management objectives for new development. These are to:

- Minimise any changes to flood behaviour
- Minimise any changes in flood risk to the existing community
- Minimise any impacts on the safety of the existing community responding to floods.
- Consider risk to life to the users of new development in floods, including extreme events.
- Reduce the impacts of flooding on the new development and its users
- Consider the role and functionality of key community uses, such as community hospitals, in floods, including extreme events
- Consider adaptability to changing flood risks due to climate change

These can equate to the following land-use planning objectives:

- Risk to life is considered for flood events up to extreme events
- Key community uses consider functionality in floods up to extreme events
- The risks posed by flooding to existing development and the existing community are not increased by new development in the floodplain
- Economic and social costs that may arise from damage to new development from flooding are not be greater than that which can reasonably be managed by the community
- Adaptability to changing risks due to climate change are considered in decisions

3. Implication of developing in different areas of the floodplain

Flood behaviour and exposure to flood risk vary across the floodplain and between events of different magnitude. Understanding this variation and the implications of developing in different areas of the floodplain on land uses, their users and the broader community can influence the constraints that flooding may place on development. This understanding can be developed independent of any existing or proposed use of the land. It can provide essential information when considering development within the floodplain.

The key flood related factors that can influence the likelihood and consequences of flooding on land uses, their users and the broader community are as follows:

- **Frequency of exposure to flooding.** Mapping the extents of different frequencies of flooding including the defined flood event (planning flood, in NSW, often the 1% AEP flood or a similar scale historic flood event) and the probable maximum flood (PMF, or other similar extreme event) provides a basis for understanding relative exposure of different areas of the floodplain to flood impacts.
- **Flood function.** In any flood, different areas of the floodplain have different flood related functions.
 - Flow conveyance areas (or floodways) are essential to convey flow from one location to another. If these are altered (such as by placing development in these areas or by changing the topography or vegetation in these areas), behaviour can alter substantially. This can alter flood behaviour with implications to the impacts and risks of flooding to the broader community.
 - Flood storage areas can store water due to natural or man-made features during a flood event resulting in a reduction in downstream flows. In some cases significant changes to these areas can alter flood behaviour with impacts upon the broader community.
 - Flood fringe areas are outside flow conveyance and flood storage areas and are not important to the maintenance of flood function in the flood event being examined.

Flood function is generally examined in the defined flood event (planning flood) with an assessment of significance of differences of behaviour in floods rarer than the DFE relative to the DFE also made. Consideration of larger events takes particular note of new flow conveyance paths (or floodways) that may develop as these may be areas that need closer examination when considering future development.

- **Flood hazard.** Flood hazard is generally assessed based upon a combination of the velocity and depth of flooding. The implications of flood hazard can be related to the potential for impacts to people, vehicles and people in vehicles, and in relation to structural damage or destruction of buildings, as outlined in Guideline 7-3.
 Different areas of the floodplain are exposed to different degrees of flood hazard during a flood event. Flood hazard is generally examined for the DFE and a flood or floods larger than the DFE as flood hazard also varies between events of different sizes. Significant changes in flood hazard in floods larger than the DFE flood relative to the DFE can identify areas where flood hazard may need additional consideration.
- **Isolation from safety.** Isolation of an area from safety and the potential for inundation of this area by flooding are important to understand as they can highlight the potential for emergency management issues of different degrees of consequence. Guideline 7-2 provides the ability to distinguish between different degrees of isolation and their consequences due to flooding considering the full range of flood events. This enables areas with emergency response difficulties to be identified so that this can be considered in decisions on managing the floodplain.
- **Flood range.** This is examined in relation to understanding both the upper limit of flooding and its implications including: the difficulty of emergency response (through emergency response classification, discussed above) and also to identify areas where flood function and in some cases hazard changes substantially between the planning floods and floods rarer than the planning flood. Considering these issues can build an understanding of the consequences of larger floods into decision making.

Understanding how these issues vary across the floodplain can assist in land use planning activities on both where to locate development within the floodplain and the controls and limitations that may need to be placed on development to address these varying flood constraints. Guideline 7-5 provides some examples of how this information can support land use planning activities. Table 1 from the guide, given below, provides an indication of the implications and key flood aspects to consider in developing in different areas of the floodplain based upon FPCCs.

Table 1 – Flood planning constraint categories – implications - From Guideline 7-5 Table 1

FPCC	Constraint	Implications	Key Considerations
1	Overall	In addition to the implications and considerations for FPCC2	
	DFE event flow conveyance and storage areas	Development or changes to topography within flow conveyance areas and flood storage areas affect flood behaviour, which will alter flow depth or velocity in other areas of the floodplain. Changes can negatively affect the existing community and other property	The majority of developments and uses have adverse impacts on flood behaviour. Consider limiting uses and development to those compatible with maintaining flood function
	H6 hazard in DFE	Hazardous conditions considered unsafe for vehicles and people. All building types are considered vulnerable to structural failure	The majority of developments and uses are vulnerable to failure in this flood hazard category. Consider limiting developments and uses to those that are compatible with flood hazard H6
2	Overall	In addition to the implications and considerations for FPCC3	
	Flow conveyance in floods larger than the DFE	Flow conveyance areas may develop during an event larger than the DFE. For example, 0.2% AEP if 1% AEP is the DFE. People and buildings in these areas may be affected by flowing and dangerous floodwaters	Consider compatibility of developments and users with rare flood flows in this area
	Flood hazard H5 in DFE	Hazardous conditions are considered unsafe for vehicles and people, and all buildings are vulnerable to structural damage	Many uses and developments will be vulnerable to flood hazard. Consider limiting new uses to those compatible with flood hazard H5. Consider whether it is feasible to reduce flood hazard by treatments such as filling (where this will not affect flood behaviour) to reduce the hazard to a level that allows standard development conditions to be applied. Alternatively, consider a requirement for special development conditions
	Emergency response— isolated and submerged (FIS)	Area becomes isolated by floodwater or impassable terrain, with loss of evacuation route to the community evacuation location. The area will become fully submerged with no flood-free land in an extreme event, with ramifications for those who have not evacuated and are unable to be rescued	Consequences of isolation and inundation can be severe. Consider the consequences of: <ul style="list-style-type: none"> evacuation difficulty or inundation of the area on the development and its users, which may include limitations on land use, or on land use that has occupants who are more vulnerable to disruption and loss the development on emergency management planning for the existing community, including the need for additional treatments the development on community flood recovery disruption or loss of the development on the users and wider community
	Emergency response— isolated but elevated (FIE)	Area becomes isolated by floodwater or impassable terrain, with loss of an evacuation route to a community evacuation location. The area has some land elevated above the extreme flood level. Those not evacuated may be isolated with limited or no services, and will need rescue or resupply until floods recede and roads are passable	Some developments and their users may be vulnerable to disruption or loss. Consider: <ul style="list-style-type: none"> the consequences of disruption or loss of the development on the users and the wider community limiting land use, or land use that has occupants who are more vulnerable to disruption and loss additional emergency management treatment requirements issues associated with the level of support required during a flood, particularly for long-duration flood events
	Flood hazard H6 in floods larger than the DFE	Hazardous conditions may develop in an event rarer than the DFE, which may have implications for the development and its occupants	Consider the need for additional development conditions to reduce the effect of flooding on the development and its occupants
3	Outside FPCC2. Usually below the DFE plus the freeboard	In addition to the implications and considerations for FPCC4. Hazardous conditions may exist creating issues for vehicles and people. Structural damage to buildings that meet building standards unlikely because of flooding.	Standard land-use and development controls aimed at reducing damage and the exposure of the development to flooding in the DFE are likely to be suitable. Consider the need for additional conditions for emergency response facilities, key community infrastructure and vulnerable users
4	Outside FPCC3, but within extreme event such as PMF	Emergency response may rely on key community facilities such as emergency hospitals, emergency management headquarters and evacuation centres operating during an event. Recovery may rely on key utility services being able to be readily re-established after an event	Consider the need for conditions for emergency response facilities, key community infrastructure and land uses with vulnerable users

4. Flood Planning Constraint Category Mapping and Typical Constraints

The concept of Flood Planning Constraint Categories (FPCCs) was developed to simplify how information on the many different flood issues that can impact upon development decisions in the floodplain can be provided to support land use planning activities as outlined in Guideline 7-5. FPCCs enable this information to be more readily used to inform land use planning activities

without losing the ability to examine the detail of specific constraints at particular locations. The concept of FPCC's results in the following:

- A single map or set of maps outlining the location of the four (4) different FPCCs which provide advice as to the relative severity of flood constraints considering the full range of flood events and the full range of flood related issues. These go from the areas with the most severe constraints, FPCC1, to FPCC4 with the least constraints.

FPCC1 and FPCC2 capture land that is highly constrained and may, in some cases, be unsuitable for intensification of development. This may be due to: the impacts development of these areas would have on flood behaviour and the flood risk and flood emergency response of the existing community or the degree of flood constraints that new development would need to address to manage the flood risks to the development and its users.

The majority of new development types are likely to be excluded from **FPCC1** due to their impacts upon flood behaviour and their vulnerability to the degree of flood hazard. The exception is those limited uses that are compatible with the flood function and flood hazard in the area. Consideration should be given to limiting growth in exposure of existing development not compatible with flood function or hazard.

FPCC2 is the next least suitable area for new development due to the impacts of flooding on the land and the consequences to the development and its users. Some FPCC2 areas are likely to be unsuitable for new development whilst other areas have some development potential but with significant constraints. Consideration should be given to limiting growth in exposure of existing development where the associated risks cannot be effectively managed.

FPCC3 areas are more suitable for new development and expansion of existing development when flood related development conditions are met. Consideration may be given to restricting emergency response facilities and vulnerable land uses in some areas.

FPCC4 identifies areas where only some types of new or expanded land uses, typically developments used in an emergency response, those with vulnerable development, are likely to have flood related development conditions.

The base information deriving these categories is flexible to allow for varying needs and flood problems. The detail can be considered by developing and examining either FPC Sub-category mapping or the base information. This mapping can be used to understand the implications of developing in different areas of the floodplain and to split the floodplain into areas where the scale of flood constraints required to meet the floodplain management objectives identified in Section 2 are similar. Table 1 indicates the typical constraints that feed into each FPCC. An example of some of the base mapping used to derive FPCC mapping (Figure 6) is provided in Figures 1 to 5.

Table 2 provides typical constraints and possible land use planning and building treatment options and controls to address the different constraints and implications of these constraints in consideration of the floodplain management objectives outlined in Section 2.

A key consideration is that the constraints from higher numbered FPCCs will also apply to lower numbered FPCCs. This means that:

- FPCC4 constraints also apply to all areas within FPCC1, FPCC2 and FPCC3.
- FPCC3 constraints also apply to all areas within FPCC1 and FPCC2.
- FPCC2 constraints also apply to all areas within FPCC1.

Therefore as the FPCC number reduces the degree of flood constraints needed to meet the floodplain management objectives increases. Land within FPCC3 and FPCC4 will need less assessment to development and the cost of meeting flood related development controls is likely to be lower.



Figure 1 - Flood extent and depth for the defined flood event

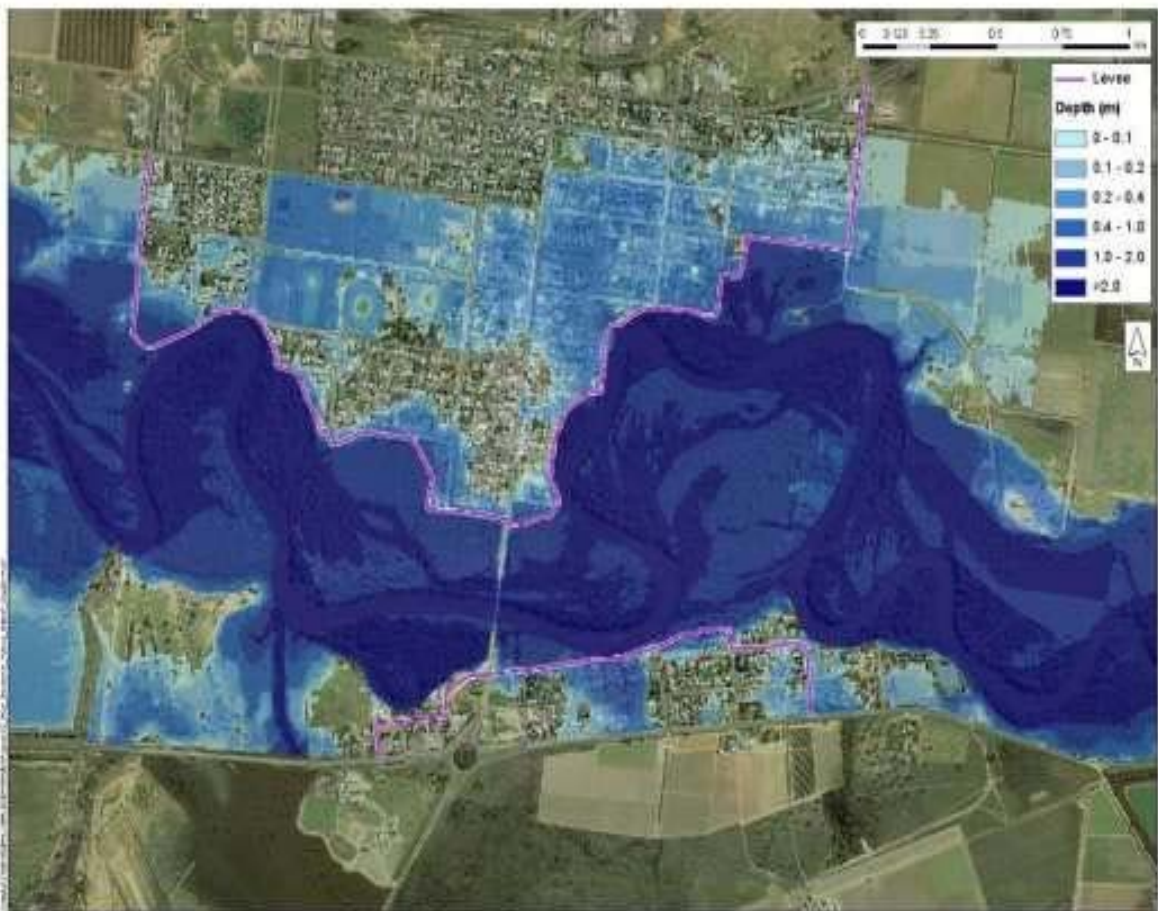


Figure 2 - Flood extent and depth for an extreme flood

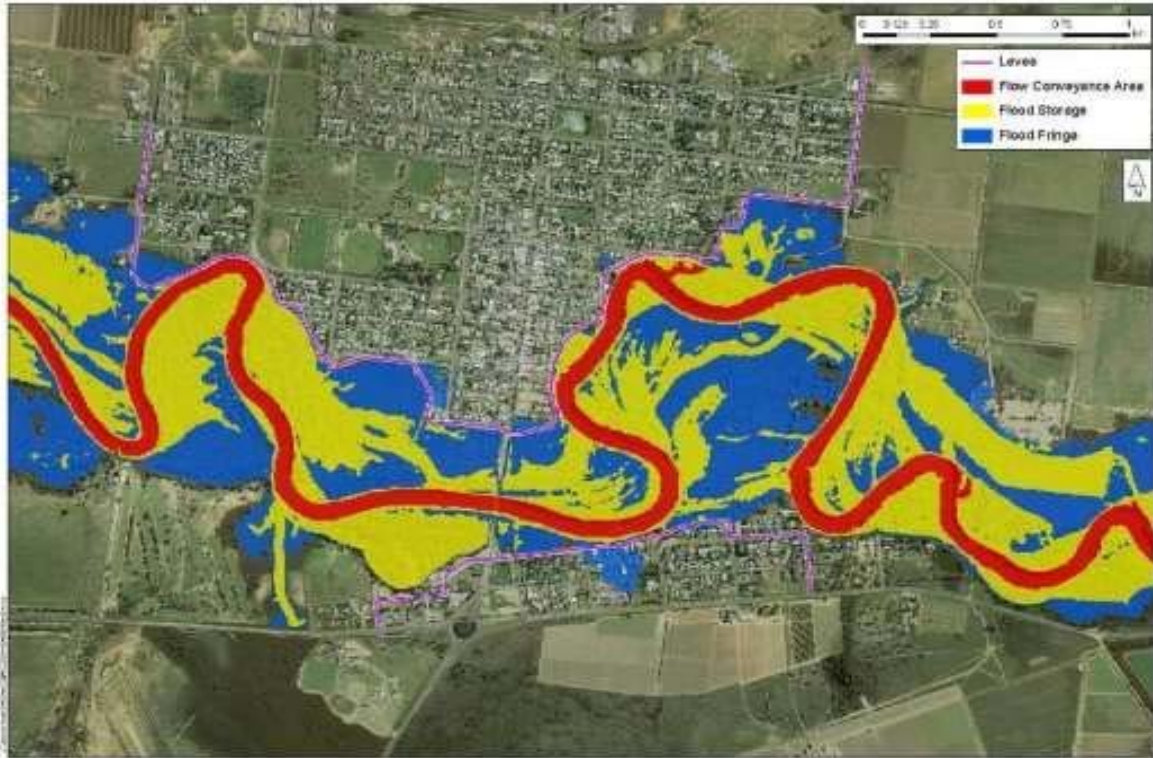


Figure 3 - Flood Function for the Defined Flood Event

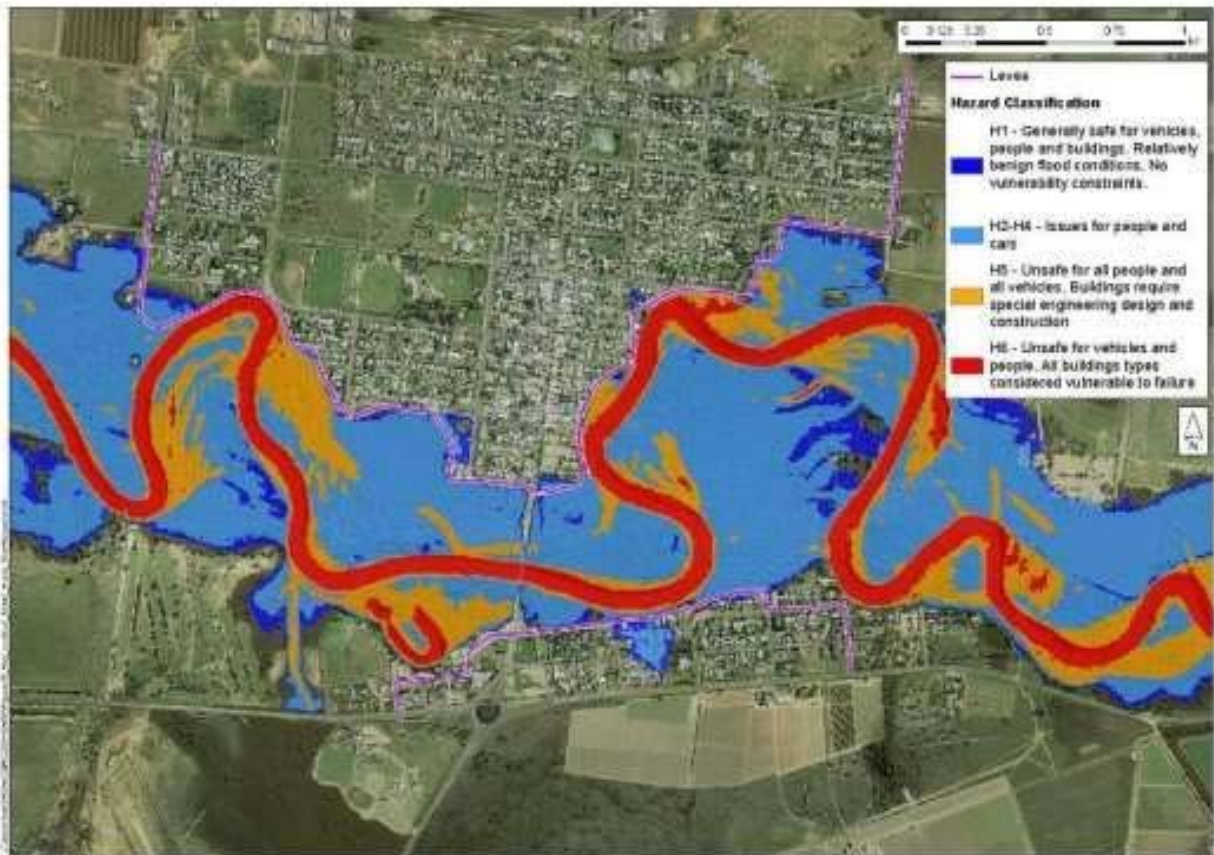


Figure 4 – Flood Hazard for the Defined Flood Event

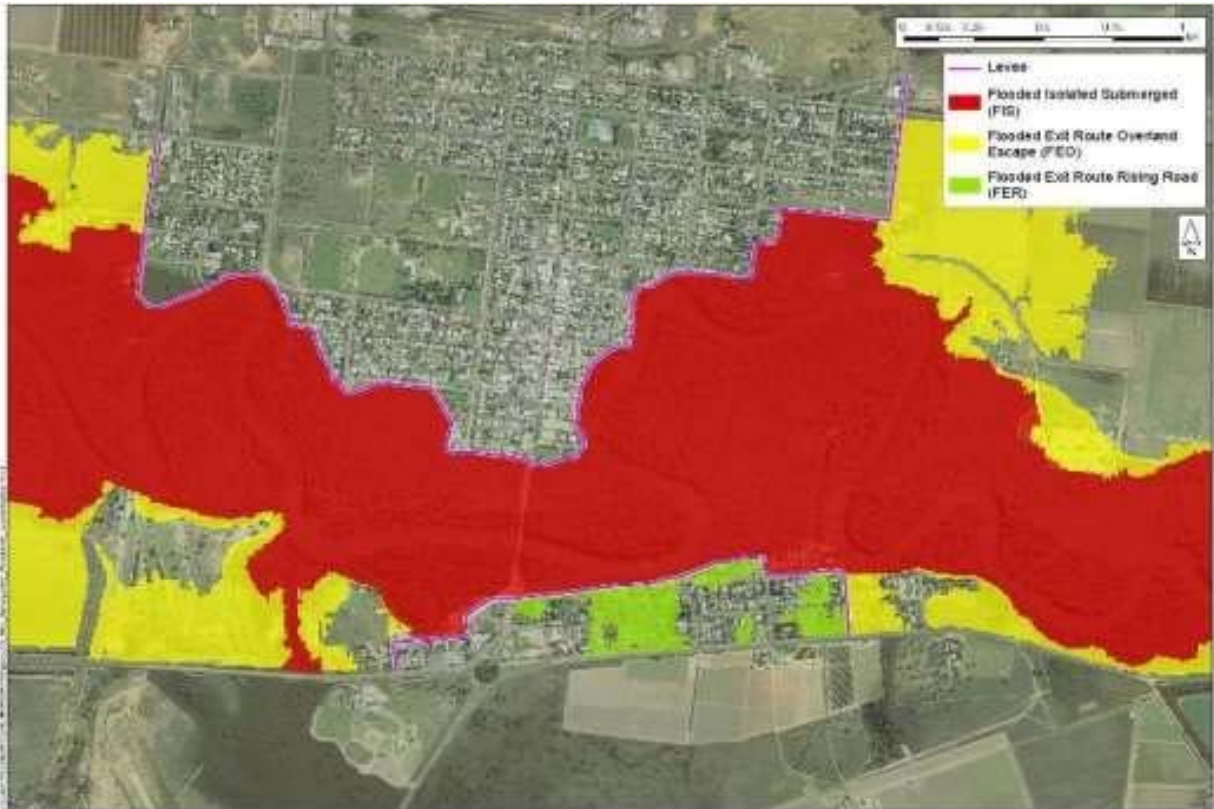


Figure 5 - Flood Emergency Response Classifications

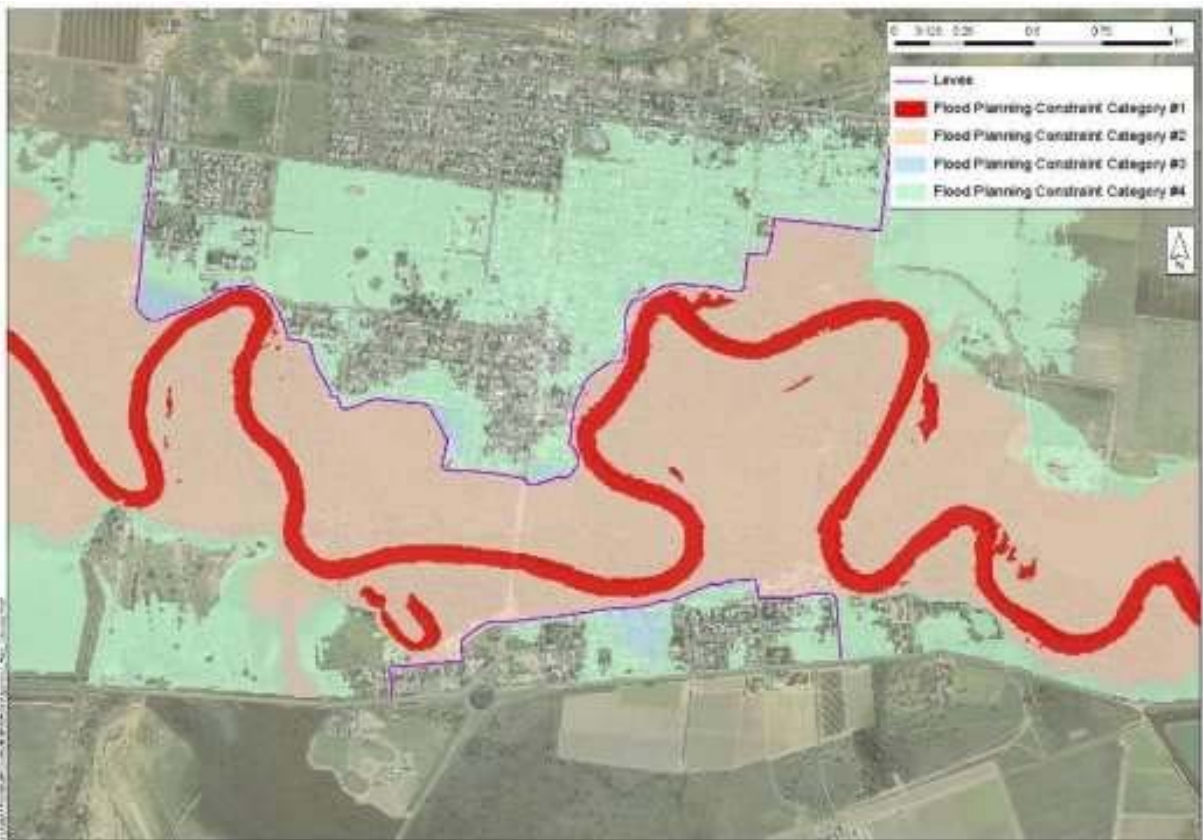


Figure 6 - Flood planning constraint categories

Table 2 Example of Floodplain Management Objectives, Constraints and Possible Treatment Options and Controls

Floodplain Management Objectives	Land Use Planning Objectives	FPCC	Constraint	Possible Land use Planning and Building Treatment Options and Controls ^a for area
<p>1. Minimise new development impacts on</p> <ul style="list-style-type: none"> • Flood behaviour • Flood risk to the existing community • Safety of the existing community responding to floods <p>2. Reduce the impacts of flooding on development and its users.</p> <p>3. Key community uses consider functionality in extreme events</p>	<p>1. Risks to life considered for events up to extreme events</p> <p>2. Key community uses consider function in events up to extreme events</p> <p>3. The risks posed by flooding to existing development are not increased by new development likely to occur in the floodplain</p> <p>4. The risks posed to the existing community by flooding are not increased by new developments that are likely to occur in the floodplain</p> <p>5. Economic and social costs that may arise from damage to new property from flooding are not be greater than that which can reasonably be managed by community</p>	1	Overall	In addition to development controls in FPCC2.
			DFE event flow conveyance & storage areas	Development is discretionary provided it does not adversely affect flood function. This is likely to result in a significant restriction on intensification of development or new development.
			H6 Hazard in DFE	Intensification of existing and new key community, utility and vulnerable, residential and commercial uses may be prohibited. Intensification of other existing uses and new uses discretionary provided detailed risk assessment can demonstrate that an appropriate mix of planning, building and emergency management controls can effectively manage the risks to the use and occupants.
		2	Overall	In addition to controls in FPCC3
			Flow conveyance in larger events	Development discretionary provided development does not adversely affect, and is compatible with flood function.
			Flood Hazard H5 in DFE	New key community, utility and vulnerable uses may be prohibited. Intensification of existing key community, utility and vulnerable uses discretionary provided that a detailed risk assessment can demonstrate that an appropriate mix of planning, building and emergency management controls can effectively manage the risks to the use and the occupants. Intensification of other existing uses and new uses discretionary provided that a detailed risk assessment can demonstrate that an appropriate mix of planning, building and emergency management controls can effectively manage the risks to the use and the occupants.
			Emergency Response – Isolated and Submerged (FIS)	Consideration should be given as to whether to minimise more intense development in these areas. New key community, utility and vulnerable uses may be prohibited. Intensification of current use and new uses or developments is discretionary provided that a detailed risk assessment can demonstrate that an appropriate mix of planning, building and emergency management controls can effectively manage the risks to the use and the occupants.
			Emergency Response – Isolated but Elevated (FIE)	Consideration should be given as to whether to minimise or prevent more intense development in these areas. Key community, utility and vulnerable uses discretionary provided a detailed risk assessment can demonstrate that an appropriate mix of planning, building and emergency management controls can effectively manage the risks and ensure continuity of service. Intensification of existing uses and new uses or developments is discretionary provided that a detailed risk assessment can demonstrate that an appropriate mix of planning, building and emergency management controls can effectively manage the risks to the use and the occupants.
			Flood hazard H6 in larger events	All uses and developments including key community and utility uses discretionary provided a detailed risk assessment can demonstrate that an appropriate mix of planning, building and emergency management controls can effectively manage the risks and ensure continuity of service.
		3	Outside FPCC2. Generally below DFE+ freeboard	In addition to controls in FPCC4 All other uses and developments are permitted provided they meet flood specific planning conditions such as meeting minimum fill and floor level and specific building and access requirements.
			4	Outside FPCC3 but within PMF (or similar extreme event)

Table 2 provides some examples of typical treatment measures and development controls which should only apply where risks associated with specific conditions within the floodplain have been tested to show these control risk to acceptable levels. Treatment solutions for flash flood environments will be different to those for floodplains with sufficient flood warning time. Local and jurisdictional policies and planning instruments may influence controls used and where they may apply.

5. Use of FPCC's in strategic land use planning activities

Strategic land use planning examines both the demands for community growth and the associated needs for additional land uses with an understanding of the available land and the constraints imposed on it by many factors (including flooding) and the opportunities that may arise from factors such as transport links or nodes. In that way, land use planning aims to balance these considerations to develop a robust and sustainable land use strategy for future growth of the community in light of the opportunities and constraints on development of the community.

Flood constraints on land in different areas of the floodplain are important to understand and consider early in decision making to contribute to decisions about which areas to develop in and what type of development to target where. This involves an examination of both:

- the impacts that development of different areas would have on flood behaviour and the flood risk and flood emergency response of the existing community.
- The degree of flood constraints that new development would need to address in different areas of the floodplain. This can impact upon the cost, practicality and sustainability of development.

Consideration of these factors early in the strategic decision making process can limit the potential for strategic directions that place development in locations where the risks to the development and its occupants or the additional risks created by the development on the existing community are not sustainable or may only be made sustainable through large scale investment to reduce the associated risks.

The flood information available to support these exercises may include:

- Simple information such as a map of flood extents for the DFE (Figure 1) and possibly the PMF (Figure 2). This may lead to a simple consideration of flooding, often excluding development from within the DFE, managing flooding within the flood planning areas, and assuming there is little or no need to limit development due to flooding in areas outside the flood planning area. This can lead to:
 - Land suitable for development being excluded from development (i.e.) some land within the DFE can be developed in consideration of appropriate constraints.
 - Land that may be unsuitable for development, or unsuitable for certain types or scales of development, due to flood risk being earmarked for development. This may apply to certain areas outside the flood planning area and within the extent of extreme events.
- Complex information on a range of different maps (such as figures 1 to 5) including flood conveyance (flood ways), flood storage, varying degrees of flood hazard, and possibly isolation of areas from safety. This information looked at independently can be difficult to interpret and understand without expert input to assist in balance of the differing issues and effectively use in decision making. Therefore it may not have been able to be used as effectively and efficiently as possible in strategic planning exercises.
- FPCCs, as shown in Figure 6, which can be derived by flood risk management professionals from an interpretation of the complex information from flood studies undertaken under the floodplain-specific management process (Figure 1-5) using the process outlined in Guideline 7-5. The process of deriving FPCCs was developed specifically to provide a basis for enabling a better but more readily understood understanding of the degree and type of flood constraints that may apply across different areas of the floodplain so that this can inform land use planning activities.

FPCCs can be used to provide advice on the relative suitability of the land for development, the scale of constraints that may be expected to apply in to different areas of land, and, in considering the vulnerability of different developments and their users to flooding, the types

of development that may be more suitable for the location given the different flood constraints applying to land. For example:

- Developments which have a role in emergency response are best placed in areas outside the floodplain or in areas with limited and readily manageable flood risk so they can fulfil their emergency response role during a flood.
- Developments whose occupants are likely to be at particular risk in an evacuation are best placed in areas where evacuation is less likely and when needed is more straightforward and can be achieved within the available resources.

Therefore FPCCs have advantages over other forms of information. They:

- Can enable consideration of more complex information than simple mapping of flood extents but are able to provide this in a manner that is more efficient and effective in informing decision making
- Are supported by advice on some typical information on flood constraints (Tables 1 and 2)
- Are supported with advice on the roles different types of developments may play in emergency response to a flood (Table 3)
- Are supported with advice on the typical variation in the relative vulnerability of different types of development and their occupants to flooding (Table 3).
- Can still be derived from flood studies under the floodplain-specific management process outlined in Handbook 7

Table 3 Examples of relative vulnerability to flooding for the same exposure to flooding

Type of Use	Element at risk			Use in Emergency Response	Comment
	Building	Contents	Occupants		
Standard Residential	Base	Base	Base	No	
Medium / High Density Residential	Lower	Higher	Higher	No	Higher density but buildings often stronger
Rural residential	Lower	Lower	Lower	No	Lower density, can be limited architectural and structural engineering investment
Community Hospital with medical emergency facilities	Lower	Higher	Higher	Yes	Occupants on average more vulnerable in evacuation. Facility needs to be able to operate and be accessible during an event or have an alternative and evacuation plan.
Aged Care Facilities	Lower	Higher	Higher	No	Occupants on average more vulnerable in evacuation
Schools	Lower	Lower	Higher	Possible	Occupants on average more vulnerable in evacuation
Community Facility	Lower	Lower	Varies	Possible	Users are generally itinerant and the type of occupants and their exposure to flooding will depend on the nature of the development.
Service Club	Lower	Lower	Higher	Possible	Employees may be able to be trained. Customers likely to be unfamiliar with location or flood issue
Emergency Response Facility	Lower	Lower	Lower	Yes	Facility needs to be able to operate and be accessible during an event or have alternate arrangements
Commercial	Lower	Varies	Employees Lower Customers Higher	No	Employees may be able to be trained. Customer density high, likely to be unfamiliar with location or flood issue
Industrial	Lower	Varies	Lower	No	Employees may be able to be trained, customer density low. Customers likely to be unfamiliar with location or flood issue
Agricultural	Lower	Lower	Lower	No	

6. Use of FPCC in the Land Use Planning System

FPCCs were developed to inform rather than to be directly used in land use planning system. For example FPCC mapping is not the same as the mapping required to support flood related Local Environmental Planning clauses used in the NSW land use planning system.

However, in NSW a range of local councils use additional mapping in their Development Control Plans (DCPs) to provide more specific advice on the flood related development controls that may apply to particular areas of land. One example is the breakdown of the floodplain into low, medium and high flood risk precincts to differentiate areas with similar development controls used by number of NSW local councils.

The breakdown of the floodplain into FPCCs is consistent with this concept as development controls can be derived for these FPCCs in consideration of the different development constraints.

Tables 4 and 5 provide an example of a development control matrix for the different FPCCs derived from an existing matrix based upon low, medium and high risk precincts. These tables are examples only to highlight the utility of the categories. Note that these tables should not be used directly. Using FPCCs in this manner would require the development of specific planning controls that are fit for purpose within the context of the community and the flood threat it faces.

7. Conclusions and Recommendations

Flood planning constraint categories can support a range of land use planning activities. Whilst specifically aimed at informing strategic land use planning activities, they are also consistent with existing approaches used in development control plans (DCPs).

They have advantages as they can be derived from flood studies under the floodplain-specific management process outlined in Handbook 7 and therefore can be made available to inform land use planning activities whilst work on examination of management options continues.

Their derivation involves the use of complex information from the floodplain specific management process and its interpretation in a consistent manner (as outlined in Guideline 7-5) by flood risk management professionals to create a single map or map set that is more efficient and effective in informing land use planning activities than the associated base mapping.

FPCCs are supported by:

- Some typical advice on flood related constraints in different FPCCs (Tables 1 and 2)
- The typical roles different types of developments may play in emergency response to a flood (Table 3)
- The typical variation in the relative vulnerability of different types of development and their occupants to flooding (Table 3).

8. Acknowledgements

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